



WATER RESOURCES RESEARCH GRANT PROPOSAL

Title: Erosion and Sedimentation on St. John U.S. Virgin Islands

Duration: September 1997 - August 1999

Federal Funds Requested: \$59,707

Non-Federal Funds Pledged: Matching requirement not applicable to VIWRI

Principal Investigators:

Dr. Henry Smith, University of the Virgin Islands, St. Thomas, U.S. Virgin Islands

Dr. Lee MacDonald, Colorado State University, Fort Collins, CO

Congressional District: Not Applicable

Critical Regional Water Problems and Need for Research:

Tourism is a dominant component of the economy of the U.S. Virgin Islands as well as Puerto Rico, many of the other eastern Caribbean nations, and parts of the southeastern U.S. A primary attraction of these areas is the beaches and offshore marine life. Preliminary research on St. John suggests that increased erosion from the rapid development of both public and private lands is the single greatest threat to the coral reefs and other offshore marine resources (MacDonald et al., in press). Similar concerns exist on St. Thomas, and reservoir sedimentation is a critical issue on Puerto Rico. Effective land use planning can only take place if there is a basic understanding of runoff and erosion rates at the plot, hillslope, and small catchment scale, and how these vary across the landscape. Runoff and eroded sediment then have to be routed down through the stream network to the locations of interest, and this is particularly difficult in the highly variable hydrologic environments found in the eastern Caribbean. Of particular interest is the highly variable amount of sediment storage on the hillslopes, the different sequences of storms that tend to saturate varying areas of the island and the very different responses in runoff volumes to different storm sizes. Current prediction tools have been largely developed in agriculture areas in the eastern and central U.S., and there is an urgent need to calibrate these models to the dry tropics.

Our initial work on St. John has suggested that unpaved roads were the primary source of anthropogenic sediment (MacDonald et al., in press). A crude road erosion prediction model indicated that sediment delivery to the marine environment was at historically high levels. A preliminary field investigation in the latter half of 1996 and early 1997 provided a limited amount of runoff and erosion data at the plot and small catchment scale, but the usefulness of this work was limited by a series of methodological and other problems. A more rigorous quantification of the amounts of natural and anthropogenic

runoff and sediment will require more intensive efforts in different vegetation types and rainfall zones at a variety of spatial scales. Simultaneous work at several scales is necessary to predict the delivery of eroded sediment into and through the stream channel network. This quantification of runoff and erosion rates in different environments and at different spatial scales is critical for building more general models, extrapolating the results to other areas, and providing guidance for sediment reduction efforts. Marine ecologists and other scientists should be able to use the spatially-explicit estimates of sediment delivery to predict the effects of changing land use.

Results, Benefits, and Information to be Gained:

The primary product from this project will be a set of spatially-distributed, GIS-based models that predict runoff and sediment delivery given storm and watershed characteristics. The second product from this project is a unique set of runoff and erosion data that will serve to calibrate and test the more broadly applicable models that will be developed under the proposed project. A 3-5 day workshop will be conducted at the end of the project to both disseminate the primary results and provide training to resource managers, government agencies, and other interested parties. User manuals and other model documentation will be distributed to ensure that both model users and model consumers are aware of the proper assumptions, use, and limitations of the model(s). A two day workshop designed for local citizens, contractors, consultants and government officials will be held to describe our findings and disseminate possible best management practices.

The project will also prepare a final report that summarizes the data collection techniques, analyses, results, and reasoning followed during model development and testing. Copies of the field data will be available in both hard copy and digital format, and this will help ensure their widest possible dissemination and use. The work conducted under this project is expected to yield several peer-reviewed articles. In particular, the testing and calibration of runoff and erosion models in tropical areas will be of considerable practical interest, as will the delivery of sediment through an ephemeral stream network. Finally, the data collected under this project will be a unique and significant contribution to our extremely limited knowledge of erosion rates and sediment yields in dry tropical forests (Murphy and Lugo, 1986). Erosion data from roads and other disturbed areas will be even more significant, as we are not aware of any comparable data from the dry tropics. It will provide documentation of principles that can be built upon during further work in the eastern Caribbean and identify areas where further study should be concentrated.